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THE

ALLEGED DETERIORATION OF LOCAL SUPERPHOSPHATE.

GEO. L. SUTTON,
COMMISSIONER FOR THE WHEAT BELT.

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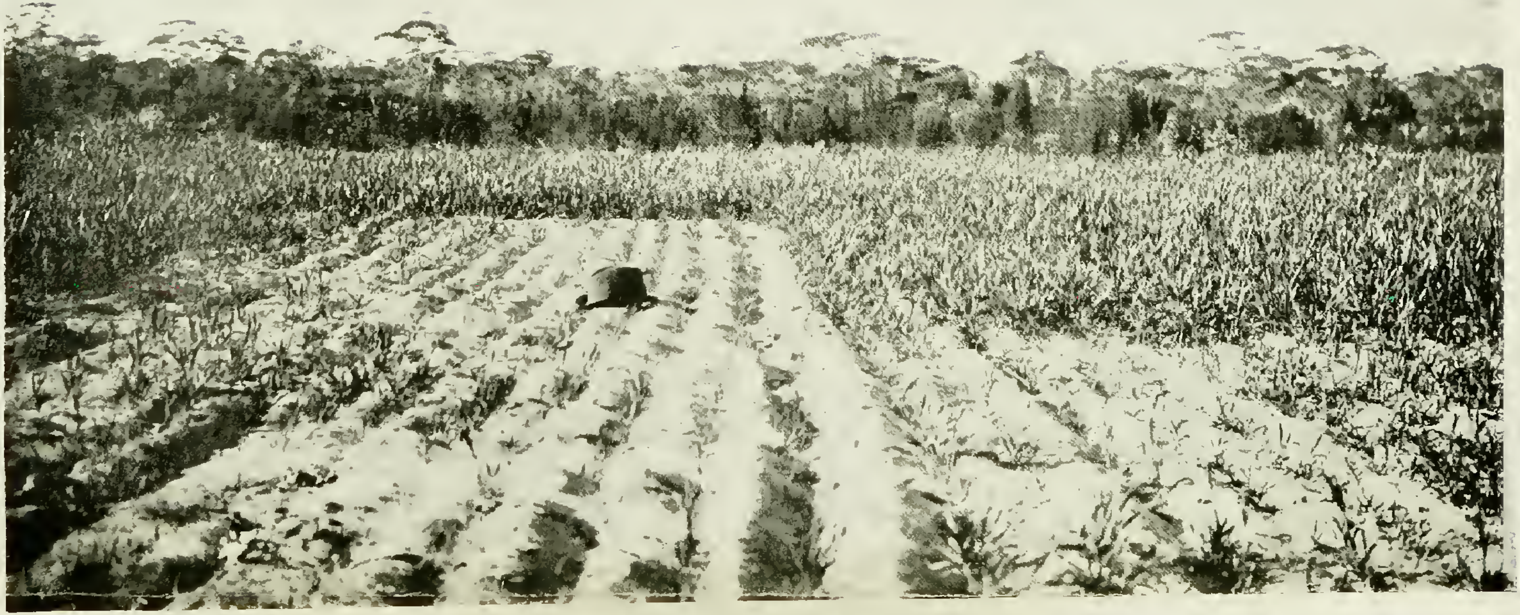

SUPERPHOSPHATE ON LIGHT LAND.

[illegible] application of superphosphate which the drill failed to sow on the strip where [illegible] ally a failure.

THE ALLEGED DETERIORATION OF SUPERPHOSPHATE.

GEO. L. SUTTON,
COMMISSIONER FOR THE WHEAT BELT.

Whilst very gratifying returns have been obtained by many of our wheat growers during the season just ended, there are unfortunately some cases in which the yields have been very disappointing, and not at all equal to those anticipated and estimated. From correspondence received and verbal statements made to me during recent visits to country districts, it is evident that there are many who believe that the cause of the disappointing yields is due to an alleged decrease in the quality of the local superphosphate now supplied. It is thought by those making the statements that the superphosphate now supplied is entirely different to that supplied a few years ago, and has a reduced fertilising value. The argument advanced in favour of this belief is somewhat as follows: Previously on land prepared and cultivated, exactly as is being done at present, the effect of an application of superphosphate was most marked, but now the effect is hardly, if at all, discernible; therefore, it is incorrectly reasoned, the low yield is due to the decrease in the quality of the superphosphate now being supplied. Such reasoning is defective, in that it fails to recognise that the application of superphosphate strengthens one only of the several links in the chain of details necessary for the successful cultivation of crops.

An application of superphosphate increases the amount of phosphoric acid in the soil available for the immediate use of plants, and in cases where a deficiency of available phosphoric acid is the only essential factor lacking in connection with crop production, a comparatively light application of superphosphate is attended with almost magic results. An application of superphosphate cannot, however, make up for other soil deficiencies such as lack of air, consequent upon the ground becoming water-logged or boggy, or of moisture or of available nitrogen or potash. Until these deficiencies (when they occur) are remedied, superphosphate cannot exercise any marked beneficial influence upon the crop yield, even though the soil is also deficient in phosphoric acid which is available for the immediate use of plants.

It is true that the guaranteed composition of superphosphate at the present time is slightly different from that prior to July, 1916. Since that date there has been a reduction in the guaranteed percentage of citrate soluble and acid soluble phosphoric acid of .5 and 1.5 respectively, but no reduction whatever in the amount of water soluble phosphoric acid. The value of a superphosphate depends upon almost, if not entirely, upon the amount of water soluble phosphoric acid which it contains, and in this connection the present guarantee is the same as formerly.

In order to comply with the provisions of "The Fertiliser Act," it is necessary that the fertilisers sold in this State be registered at the Department of Agriculture, and that the percentages of the different constituents of plant food contained therein be guaranteed. The local superphosphates, as supplied last season, are guaranteed to contain:—

Phosphoric Acid, Water Soluble	17 per cent.
" " Citrate "	·5 per cent.
" " Acid "	·5 per cent.

The value of superphosphate can be readily and reliably determined by chemical analysis. The average result of the analyses of samples taken last year, and without warning, is as follows:—

Phosphoric Acid, Water Soluble	17·27 per cent.
" " Citrate "	1·90 per cent.
" " Acid "	·30 per cent.

The results show that the superphosphates supplied not only comply with the guarantee but exceed it. In the fertiliser experiments at the Merredin Experiment Farm one of the plots is unmanured; alongside this plot is another to which superphosphate at the rate of 56lbs. per acre was applied. In other respects the plots were identically treated. The ground was fallowed during the previous winter, and the sowing was delayed in order to combat weed growth, principally "wild oats." The variety of wheat used was "Florence," and was sown on 4th June. The yields obtained were respectively as follows:—

	Hay.	Grain.
Superphosphate, 56lbs. ...	44cwt. 1qr. 20lbs. ..	17bus. 31lbs.
No manure	31cwt. 3qr. 20lbs. ...	14bus. 51lbs.
Difference in favour of superphosphate	12cwt. 2qr. 0lbs.	2bus. 40lbs.

The land occupied by this experiment was good Salmon Gum and Gimlet land.

The effect of the fallowing and lengthy cultivation during the entire autumn was to render available the maximum quantity of plant food from that dormant in the soil. Despite this, the effect of applying superphosphate was beneficial and resulted in an increase both of hay and grain. This would not have been likely had the superphosphate been valueless as some contend.

There is a tendency on the part of some farmers to use lime, basic superphosphate, or Abrolhos guano instead of superphosphate.

Lime cannot take the place of superphosphate, because it does not contain phosphoric acid in either an available or dormant form, and therefore does not remedy soil deficiencies of phosphoric acid as does superphosphate. Lime will improve the mechanical condition of soils and correct the acidity of sour soils; it will also tend to make available the inert plant food in the soil. To apply lime for this latter purpose to the light lands is extremely undesirable, as it is exploiting the limited fertility which they contain. A far better practice is to increase their fertility by the use of suitable fertilisers and the growth and consumption of fodder crops.

Basic superphosphate is prepared by mixing a quantity of lime with ordinary superphosphate so as to change the character of the latter from that of an acid fertiliser to one somewhat resembling in composition that of "Thomas phosphate" or "basic slag." There are two registered fertilisers of this character on the local market; these are called respectively, "basic superphosphate" and "basic phosphate." Their resemblance to "Thomas phosphate" is shown by the following registered details of these fertilisers:—

	Thomas Phosphate.	Basic Superphosphate.	Basic Phosphate.
	Per cent.	Per cent.	Per cent.
Phosphoric Acid, Citrate soluble	...	12·60	...
Phosphoric Acid, Acid ,,	14·00	1·40	14·00
Total	14·00	14·00	14.00

It will be seen that these fertilisers differ from lime in that they supply phosphoric acid, though it is not water soluble as it is in superphosphate, also the total quantity supplied is less. The total amount of phosphoric acid supplied by a ton of superphosphate is 28 per cent. greater than that supplied by the same quantity of either of these basic fertilisers.

The use of basic superphosphate has been recommended by its advocates, because the best result with superphosphate can be only obtained in soils which are not sour and which contain a satisfactory amount of carbonate of lime. Whilst this is so, the method of mixing the lime with superphosphate is not believed to be economical. The effect of such mixing is to change the water soluble phosphoric acid (obtained only at considerable expense) back into less soluble forms. If the soil requires lime, it is more advantageous to apply the lime separately, and some four or five weeks before the superphosphate, so that the change in the character of the plant food supplied may take place within the soil and not before the application of the superphosphate to it. The benefits due to the application of a readily available form of plant food are then obtained.

In order to compare Abrolhos guano with superphosphate as a fertiliser for wheat, it is necessary to state that the common object of adding fertilisers to the soil is to make up the deficiencies of *available* plant food in it. It is essential to emphasise the word "*available*" when used in connection with the plant food which the soil contains, for it is important that the difference between the quantity of plant food which is available for the immediate use of the plant and the total amount of plant food present in the soil should be clearly recognised. The total amount of plant food which any agricultural soil contains is always sufficient for a number of heavy crops of wheat, but the amount of one or more compounds *available* for immediate use is often not sufficient to produce one payable crop. For example, comparatively poor sand-plain land contains as much phosphoric acid as is required by several crops of wheat, each of twenty bushels, but on the other hand, the amount which is *available* is often not sufficient to produce one of six bushels. Even the richer forest land has often not more available phosphoric acid than is needed to produce 12 bushels.

Abrolhos guano and superphosphate resemble each other, in that each contains the plant food known as phosphoric acid, and in consequence both are phosphatic manures. They are, however, dissimilar, in that the bulk of the phosphoric acid in the superphosphate is in a form which the young plants can readily make use of at once, whereas the bulk of the phosphoric acid in Abrolhos guano is in a form similar to that already in the soil, and which cannot be used by the plants until made available by the process of time. To add Abrolhos guano to the soil is therefore to increase the *total* quantity of phosphoric acid in the soil, but not to immediately increase the amount available for the use of the plant, and in consequence the object of manuring is not being achieved.

Abrolhos guano is therefore unsuitable for supplementing the deficiency of available plant food in the soil. On the other hand, the good results—often the difference between profit and loss—following the use of superphosphate, when wheat is being planted, prove how suitable this fertiliser is for the purpose.

There are possibly a few instances where quite as good results have been obtained from an application of Abrolhos guano as from superphosphate. The only sound conclusion to be drawn from such an experience is that it was either one of the exceptional cases where the land was not in need of available phosphoric acid, or that phosphoric acid was not the only plant requirement which was deficient.

The relative agricultural values of Abrolhos guano and superphosphate as a source of phosphoric may be compared with the food values of dough and bread for human consumption. In a piece of dough the elements of nutrition may be as great or even greater than those in a piece of bread, but those in the dough are of little value for human consumption until the dough has been baked. Similarly, the total quantity of phosphoric acid in a ton of Abrolhos guano may be as great or even greater than in a ton of superphosphate, but this is of no value to the wheat grower until made available by time or by chemical treatment. If treated chemically in the usual way Abrolhos guano becomes superphosphate.

The farmer is naturally anxious to discover a cause of the disappointing yields experienced, so that if possible such may be eliminated and better results obtained in future years. It may be considered as certain that the disappointing yields are due to several rather than a single cause, and that even in the same district the low yields on two farms may be caused by conditions that are quite different. Though this is so, and it is therefore impossible to generalise as to the cause, it will serve a useful purpose to remove from the list of possible causes one which it is certain should be excluded. In this connection it may be stated definitely that whatever the real cause of the low yields on any particular farm may be, they are not due to any decrease in the quality of the superphosphate manufactured locally. This, by reliable and recognised tests, has been shown to be of excellent quality, and to supply the quantity and quality of phosphoric acid as guaranteed.

Though the belief in the lessened value of the local superphosphate has no real foundation, its tendency is extremely dangerous, for it is likely to cause wheat growers to depart from the recognised valuable practice of applying from ½ to 1 cwt. of superphosphate per acre at time of sowing. This practice is sound, because it is known beyond dispute that practically all our wheat lands, including the forest lands, are deficient in available phosphoric acid, and experience has shown that for almost the whole of the wheat areas superphosphate is the most suitable fertiliser to remedy this deficiency. Because of this, where other conditions essential to crop production are present, the use of superphosphate in the wheat belt may be considered as vital to success. To depart from the almost universal practice is therefore attended with a risk of serious financial loss. Because of this risk, farmers who desire to make a departure from the customary practice of using superphosphate are urged to do so in a small experimental way only.

Summarised, it may be stated:—

1. Recognised reliable tests show that there is no real foundation for the belief that there has been a decrease in quality of local superphosphate, and that such is responsible for some of the low yields obtained.
2. Lime cannot take the place of superphosphate.
3. The practice of using basic superphosphate or Abrolhos guano is not recommended.
4. Ordinary superphosphate is the most suitable fertiliser for practically the whole of our wheat area, and, where other conditions essential to crop production are present, is considered essential to success.
5. Because of the financial risk involved, any departure from the standard and almost universal method of applying superphosphate at time of sowing should be of a limited character only.

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